Original Articles

Cardiovascular disease mortality in Canada

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During the past two decades approximately one half of all deaths in Canada were due to cardiovascular diseases. Ischemic heart disease and cerebrovascular disease caused more than 60% and 20% of those deaths respectively.

The mortality rates for ischemic heart disease in males increased slightly until 1965 and then dropped substantially, whereas the rates for females, which were declining at least since the early 1960s, accelerated in their decline. As a consequence, the rates for males remain almost twice as high as those for females. The reductions were initially observed in males 25 to 34 years old and in all age groups of females, but became apparent in a wider range of ages in the second period reviewed (1969 through 1977).

The mortality of cerebrovascular disease has gradually diminished for both sexes since the 1950s, but the decline has been more pronounced among females, who originally had the higher rate.

Marked geographic differences in mortality rates still exist in Canada despite the decline in death rates for both ischemic heart disease and cerebrovascular disease in all regions of the country. Surprising regional differences in times of onset of these declines have been demonstrated.

For ischemic heart disease Ontario maintains the highest and the Prairies the lowest mortality rates. Quebec, despite a sustained decline, still ranks third, while the Pacific region shows the second-lowest rates in the country. The Atlantic region showed the lowest rates of decline in the period reviewed.

The reduction in the mortality of ischemic heart disease in Canada (16.4% between 1969 and 1977) must be considered real for a variety of reasons. Direct evidence is not available to elucidate whether the reduction is the consequence of reduced incidence, increased survival or a combination of the two factors. The potential role of various factors that may have contributed to this decline is briefly discussed in this article.

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Environ la moitié de tous les décès survenus au Canada au cours des deux dernières décennies sont attribuables aux maladies cardiovasculaires. Les cardiopathies ischémiques et les accidents vasculaires cérébraux ont causé respectivement plus de 60% et 20% de ces décès.

Chez les hommes les taux de mortalité liés aux cardiopathies ischémiques ont augmenté légèrement jusqu'en 1965 pour ensuite diminuer de façon importante, tandis que chez les femmes la diminution des taux, qui avait ccommencé depuis au moins le début des années 60, s'est accélérée. En conséquence, les taux de mortalité demeurent encore presque deux fois plus élevés chez les hommes que chez les femmes. Les baisses ont été observées initialement dans les hommes âgés de 25 à 34 ans et dans tous les groupes d'âges de femmes, mais au cours de la seconde période considérée (1969 à 1977) elles se sont étendues à d'autres groupes d'âges.

La mortalité liée aux accidents vasculaires cérébraux a présenté une diminution progressive pour les deux sexes à partir des années 50; la diminution a été plus marquée chez les femmes, qui, au départ, présentaient un taux plus élevé.

Bien que les taux de mortalité liés aux cardiopathies ischémiques et aux accidents vasculaires cérébraux aient diminué dans toutes les régions du pays, il existe encore au Canada des différences géographiques marquées dans les taux de mortalité. Si l'on considère le moment où les baisses se sont fait sentir, on peut constater des différences régionales étonnantes.

Pour ce qui est des cardiopathies ischémiques l'Ontario présente les taux de mortalité les plus élevés, tandis que les taux les plus faibles reviennent aux provinces des Prairies, suivies de la région du Pacifique. Le Québec, malgré une baisse soutenue, occupe encore le troisième rang. Durant la période étudiée c'est la région de l'Atlantique qui a présenté les taux de déclin les plus faibles.

La diminution de la mortalité liée aux cardiopathies ischémiques au Canada (16.4% entre 1969 et 1977) doit être considérée comme réelle pour plusieurs raisons. On ne dispose d'aucune preuve directe permettant de déterminer si la baisse de mortalité est attribuable à une incidence réduite, à une survie accrue ou à une combinaison de ces deux facteurs. Le rôle potentiel des divers facteurs qui peuvent avoir contribué à cette baisse est discuté brièvement dans cet article.

In Canada in 1977, as in any of the last 20 years, almost one half (49%) of all deaths were due to diseases of the circulatory system. These diseases con-

stituted the leading cause of "potential years of life lost"[1] and hospital admission.[2] They have also been identified elsewhere as the most significant cause of disability.[3] It is not surprising, therefore, that they have been regarded as the nation's top public health problem.

Among deaths attributable to diseases of the circulatory system, also traditionally called cardiovascular disease, those associated with arteriosclerosis are the most important because of their frequency and severity. By far the most important subgroups of cardiovascular disease are ischemic heart disease, which in the period 1973 through 1977 caused more than 60% of all deaths due to cardiovascular disease, and cerebrovascular disease, to which approximately 20% of such deaths were attributed in the same period. Interestingly, hypertensive disease, although considered a key contributing factor in most deaths due to cardiovascular disease, seldom appears as the underlying cause of death (accounting for only 2% in 1973–77). The "masking" of deaths attributable to hypertensive disease appears to be due, at least in part, to the manner in which these deaths are recorded and coded.

The aim of this communication is to draw attention to the recent changes in cardiovascular disease mortality in Canada in order to promote discussion about their interpretation and potential implications. The focus will be primarily on ischemic heart disease because it is Canada's leading cause of death, and more than one third of these deaths occur before age 70 years and could be regarded as premature.

Methods

Population and mortality data provided by Statistics Canada for the period 1950 through 1977 were analysed according to the diagnostic criteria established in the sixth, seventh and eighth revisions of the International Classification of Diseases (ICD) of the World Health Organization. The version of the eighth revision used was that adapted for use in the United States (ICDA-8).

In order to avoid misinterpretation resulting from breaks in comparability introduced by ICDA-8 (used in Canada since 1969), attention was concentrated on the period 1969 through 1977. However, the preceding period (1950–68) and the total period (1950–77) were used as a frame of reference. The calculation of comparability ratios as estimated in the United States by the National Center for Health Statistics was deemed not necessary. The ICDA-8 rubrics for the diagnostic categories studied were: cardiovascular disease, 390 to 458; ischemic heart disease, 410 to 414; cerebrovascular disease, 430 to 438; and hypertensive disease, 400 to 404.

Mortality rates were age-adjusted by the direct method, with the 1971 Canadian population (male and female combined) used as standard. Average annual percent changes were used instead of absolute percentages to compare trends and age group changes occurring during periods of unequal length (1950–52 to 1966–67 and 1969–71 to 1975–77). These were calculated by dividing the change in absolute percentage between the initial and final 3-year averages for each period by the number of years of observation.

Age-adjusted mortality rates for ischemic heart disease and cerebrovascular disease were also calculated for successive birth cohorts starting with the 10-year period 1866–75 and ending with 1911–25.

Regional mortality trends were examined for both long-term (1950–76) and short-term (1969–76) periods with the use of a linear regression model in which the slope denoted the estimated mean change (an increase or a decrease in the rate per year per 100 000 population) and the correlation coefficient represented the relation between the rate and time. The chi-square test showed a good linear fit between the rates observed and those predicted by the model.

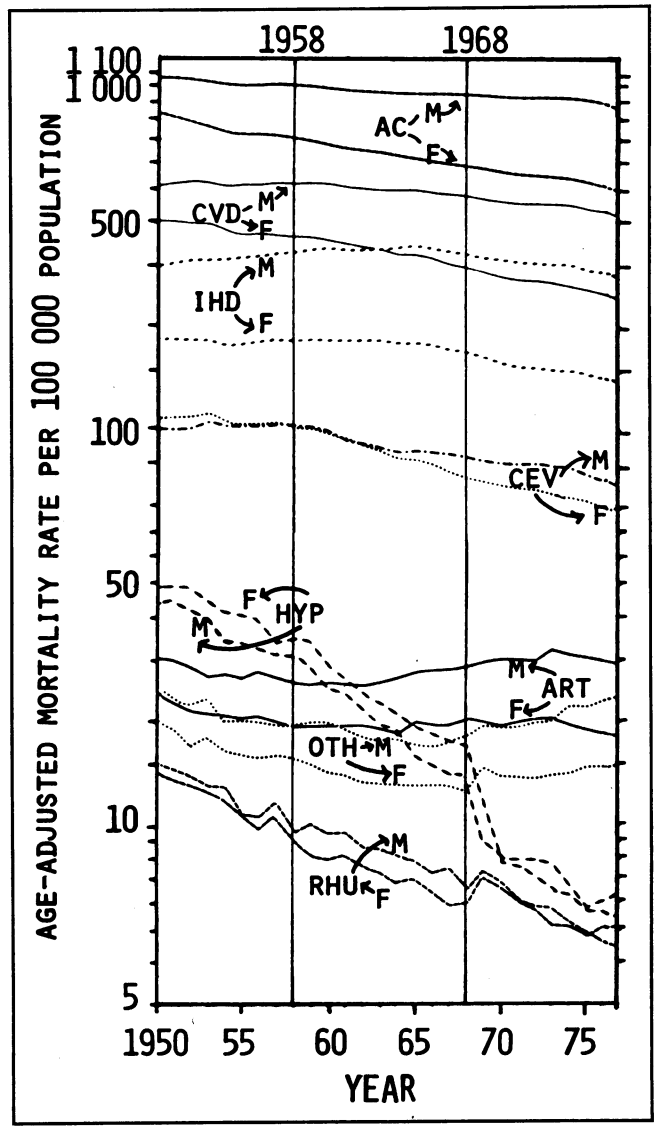

FIG. 1—Mortality trends in Canada in 1950 through 1977 for males (M) and females (F). AC = all causes; CVD = cardiovascular disease; IHD = ischemic heart disease; CEV = cerebrovascular disease; HYP = hypertensive disease; ART = arterial disease; OTH = other forms of heart disease; RHU = rheumatic heart disease.

Table I—Age-adjusted mortality rates for cardiovascular disease in Canada, by age

Year	Age (yr); rate per 100 000 population*							
	All	25–34	35–44	45–54	55–64	65–74	75–84	85+
				Males				
1950	519.5	25.1	100.4	381.7	1 082.3	2 586.9	6 346.5	13 887.4
1951	523.0	25.7	99.9	380.8	1 079.6	2 509.5	6 440.1	14 801.8
1952	526.5	26.4	113.3	393.3	1 104.2	2 543.4	6 441.9	14 329.1
1953	525.2	20.6	109.5	396.1	1 104.9	2 572.2	6 296.7	14 549.6
1954	513.5	21.3	102.5	370.0	1 080.7	2 539.2	6 253.6	14 090.5
1955	520.3	21.0	96.3	368.2	1 062.7	2 588.8	6 496.6	14 220.1
1956	518.2	20.1	101.1	362.0	1 078.0	2 576.0	6 408.7	14 222.2
1957	529.2	23.2	102.7	382.3	1 102.4	2 622.9	6 470.5	14 623.7
1958	522.9	18.5	103.0	391.8	1 096.4	2 577.4	6 364.3	14 440.7
1959	526.5	20.0	103.6	383.5	1 077.4	2 658.3	6 468.0	14 360.1
1960	525.2	16.8	100.8	384.6	1 103.5	2 605.1	6 468.4	14 317.1
1961	511.0	17.3	101.6	382.4	1 062.9	2 574.2	6 223.8	13 794.9
1962	509.3	17.7	98.4	381.7	1 051.1	2 575.5	6 175.1	13 905.1
1963	503.1	16.5	96.6	366.8	1 063.0	2 531.6	6 111.8	13 694.9
1964	499.7	16.3	98.0	380.6	1 068.0	2 504.5	6 089.2	13 182.9
1965	510.1	18.6	101.6	375.4	1 067.0	2 529.8	6 250.1	13 990.4
1966	496.9	16.4	95.5	375.1	1 042.5	2 476.1	5 972.1	13 891.2
1967	492.4	11.8	97.7	379.4	1 038.4	2 405.2	5 926.9	13 935.0
1968	489.2	16.2	91.7	359.2	1 003.1	2 455.3	5 972.7	13 679.6
1969	474.2	13.6	86.8	341.7	966.7	2 428.6	5 730.5	13 384.5
1970	468.7	13.8	83.7	337.9	988.2	2 402.2	5 692.6	12 712.1
1971	458.0	12.7	83.3	338.4	940.1	2 285.3	5 662.8	12 710.6
1972	460.5	12.8	82.6	318.0	954.1	2 365.3	5 625.4	12 769.2
1973	454.3	13.2	84.2	312.5	936.6	2 301.7	5 570.7	12 764.0
1974	455.1	12.1	81.7	320.7	922.1	2 314.3	5 641.9	12 626.1
1975	437.9	14.0	77.8	304.0	890.7	2 218.9	5 389.2	12 356.4
1976	433.5	13.8	75.3	310.4	874.8	2 171.6	5 376.0	12 205.3
1977	423.3	12.5	77.9	305.0	877.0	2 154.4	5 168.6	11 606.0
Average annual percent change								
From 1950–52 to 1975–77	–0.7	–1.9	–1.1	–0.8	–0.8	–0.6	–0.7	–0.6
From 1950–52 to 1966–68	–0.3	–2.5	–0.5	–0.2	–0.3	–0.2	–0.4	–0.2
From 1969–71 to 1975–77	–1.6	–0.4	–2.3	–2.1	–1.7	–1.5	–1.4	–1.7
				Females				
1950	404.8	18.0	62.8	197.2	607.6	1 931.9	5 632.6	13 694.6
1951	406.1	17.3	61.9	190.0	617.8	1 858.7	5 869.4	13 639.7
1952	399.7	18.6	61.2	196.4	597.3	1 860.6	5 611.0	13 775.2
1953	398.1	16.3	55.9	197.6	588.3	1 865.4	5 623.5	13 732.7
1954	377.2	15.3	48.7	172.5	545.0	1 761.1	5 326.9	13 542.4
1955	377.1	10.9	42.5	156.9	535.8	1 714.3	5 494.9	13 860.9
1956	377.6	13.0	41.8	158.8	554.0	1 711.3	5 588.4	13 371.6
1957	376.7	12.5	42.8	155.4	539.3	1 721.9	5 516.3	13 668.4
1958	366.6	12.2	39.6	144.6	501.8	1 673.0	5 405.7	13 642.1
1959	371.9	11.7	37.4	147.4	499.6	1 681.5	5 467.5	14 200.0
1960	359.0	10.9	35.8	140.1	489.4	1 598.4	5 261.2	13 955.4
1961	352.2	12.5	31.9	137.8	465.0	1 604.0	5 157.8	13 582.1
1962	345.0	11.1	33.6	124.6	461.9	1 565.0	4 986.3	13 708.3
1963	341.2	9.9	33.4	125.8	451.9	1 547.0	5 009.0	13 310.5
1964	327.0	11.8	32.7	126.7	427.6	1 464.8	4 825.5	12 718.7
1965	329.6	9.3	33.9	121.3	415.3	1 444.8	4 851.5	13 439.6
1966	319.5	10.8	30.0	115.9	424.2	1 398.0	4 681.0	12 944.8
1967	305.6	10.1	30.9	117.1	401.2	1 319.3	4 423.2	12 643.3
1968	300.5	8.4	35.0	106.1	378.8	1 307.4	4 334.8	12 721.1
1969	292.5	10.2	33.9	109.1	370.5	1 269.7	4 209.9	12 300.6
1970	283.2	9.7	32.2	100.0	356.7	1 257.8	4 101.3	11 691.5
1971	275.1	8.0	30.7	97.9	332.5	1 191.3	4 005.7	11 701.7
1972	274.2	7.9	31.6	90.7	340.8	1 189.7	3 977.1	11 722.7
1973	269.0	8.6	29.5	93.8	343.0	1 133.7	3 898.8	11 553.7
1974	267.4	8.0	28.6	96.8	328.6	1 146.9	3 905.7	11 343.1
1975	256.1	7.5	28.0	95.2	326.4	1 104.1	3 695.8	10 784.6
1976	248.1	6.6	25.8	90.4	297.9	1 065.7	3 600.1	10 681.0
1977	239.7	7.8	26.8	93.0	288.6	1 024.0	3 415.1	10 452.0
Average annual percent change								
From 1950–52 to 1975–77	–1.5	–2.4	–2.3	–2.1	–2.0	–1.7	–1.5	–0.9
From 1950–52 to 1966–68	–1.4	–2.7	–2.8	–2.5	–2.0	–1.7	–1.3	–0.4
From 1969–71 to 1975–77	–2.5	–3.4	–2.7	–2.3	–2.9	–2.6	–2.5	–2.2

*Combined male and female population in 1971 used as standard.

Table II—Age-adjusted mortality rates for ischemic heart disease in Canada, by age

Year	Age (yr); rate per 100 000 population*							
	All	25–34	35–44	45–54	55–64	65–74	75–84	85+
				Males				
1950	301.7	9.7	62.0	258.8	720.3	1 587.0	3 376.8	7 108.2
1951	306.0	9.4	65.3	264.1	724.6	1 528.6	3 499.1	7 555.1
1952	314.5	11.1	69.7	274.0	755.0	1 582.4	3 538.7	7 670.9
1953	311.6	8.5	69.4	276.4	757.8	1 591.5	3 410.7	7 624.0
1954	314.8	8.6	67.9	272.4	749.5	1 638.3	3 509.9	7 563.0
1955	321.3	8.5	64.2	271.2	777.0	1 679.2	3 666.5	7 399.2
1956	321.7	8.8	71.3	268.6	778.6	1 683.9	3 604.3	7 584.2
1957	330.5	10.9	71.0	284.5	797.7	1 747.1	3 695.5	7 567.9
1958	329.8	9.3	74.5	296.9	805.7	1 704.5	3 621.3	7 755.9
1959	335.8	9.5	76.0	296.7	807.0	1 799.9	3 696.4	7 607.7
1960	340.9	9.0	75.2	302.6	837.1	1 759.5	3 818.8	7 798.8
1961	336.4	7.6	74.0	303.3	809.2	1 790.3	3 734.2	7 564.1
1962	338.2	8.8	70.7	299.4	807.3	1 809.4	3 741.0	7 785.9
1963	338.5	8.1	72.0	291.1	810.9	1 785.8	3 799.7	7 871.8
1964	338.5	7.6	72.9	305.3	827.4	1 788.5	3 762.3	7 551.2
1965	347.1	9.4	77.0	299.9	834.3	1 802.1	3 954.7	7 957.0
1966	337.7	7.8	72.8	304.7	811.3	1 773.2	3 726.8	7 893.5
1967	335.8	6.8	74.8	308.4	808.1	1 715.3	3 724.8	8 024.7
1968	332.8	7.3	69.9	289.1	782.1	1 755.7	3 757.2	7 832.3
1969	320.1	6.6	63.6	273.1	737.3	1 735.5	3 599.1	7 593.0
1970	317.8	7.6	62.3	271.2	772.0	1 721.6	3 555.3	7 103.1
1971	309.3	5.8	62.6	268.0	735.3	1 629.2	3 535.3	7 113.5
1972	310.2	5.8	59.5	251.7	740.2	1 671.8	3 520.2	7 246.9
1973	304.7	6.4	64.0	246.5	718.5	1 627.9	3 462.4	7 218.5
1974	305.5	5.8	59.7	255.7	706.7	1 629.2	3 520.4	7 204.1
1975	293.6	6.7	59.1	244.8	682.8	1 567.4	3 353.0	6 935.8
1976	290.9	7.0	55.0	249.8	678.6	1 542.6	3 335.4	6 814.7
1977	285.2	5.4	58.4	241.7	686.1	1 510.8	3 242.8	6 534.2
Average annual percent change								
From 1950–52 to 1975–77	-0.2	-1.5	-0.5	-0.3	-0.3	-0.1	-0.2	-0.4
From 1950–52 to 1966–68	0.5	-1.6	0.6	0.8	0.5	0.7	0.4	0.4
From 1969–71 to 1975–77	-1.7	-1.1	-2.4	-2.2	-1.7	-1.6	-1.5	-1.9
				Females				
1950	185.6	3.7	17.5	69.8	273.7	936.4	2 635.4	6 590.6
1951	185.7	3.0	18.5	64.6	289.0	888.4	2 729.4	6 491.6
1952	184.5	2.8	14.4	67.9	275.5	919.3	2 594.3	6 778.5
1953	185.0	3.0	15.9	69.5	276.4	928.0	2 661.6	6 465.4
1954	176.5	2.8	11.9	64.3	260.8	894.3	2 519.6	6 321.2
1955	181.6	1.7	13.5	57.4	268.9	883.4	2 614.0	6 834.8
1956	183.6	1.4	11.7	56.3	276.9	896.1	2 756.6	6 486.3
1957	184.6	1.6	13.1	60.1	269.7	920.8	2 708.7	6 626.0
1958	181.7	1.7	13.3	64.5	260.9	895.9	2 664.5	6 571.1
1959	187.4	1.9	12.1	60.1	263.9	922.8	2 755.8	6 941.5
1960	187.2	1.9	11.4	68.0	278.4	898.8	2 758.6	6 786.4
1961	184.6	1.9	9.4	60.9	259.8	931.8	2 686.7	6 800.9
1962	185.2	2.1	11.8	58.3	268.1	911.2	2 688.4	6 933.3
1963	184.5	2.2	9.8	55.8	262.3	924.7	2 688.9	6 867.2
1964	180.1	1.9	9.8	57.4	252.3	887.1	2 640.9	6 753.7
1965	182.1	1.8	11.4	56.4	249.7	869.6	2 707.3	6 968.5
1966	178.9	2.2	11.4	57.9	253.5	866.4	2 615.9	6 765.9
1967	171.5	1.7	10.9	58.3	241.9	810.6	2 497.9	6 659.2
1968	170.7	1.7	13.8	53.3	235.0	807.2	2 436.3	6 917.5
1969	164.8	1.5	11.6	52.0	229.8	796.8	2 376.7	6 439.6
1970	161.5	1.4	10.4	48.7	214.3	809.2	2 347.4	6 213.1
1971	154.6	1.1	9.9	49.1	198.7	744.8	2 258.7	6 186.0
1972	153.9	1.4	9.8	44.9	208.0	735.8	2 234.4	6 197.9
1973	152.9	1.2	10.4	46.5	206.7	716.0	2 240.3	6 142.5
1974	152.9	1.0	10.6	51.0	205.2	723.0	2 251.6	5 990.6
1975	143.7	1.0	10.7	47.5	198.4	694.3	2 066.5	5 626.2
1976	140.1	1.0	9.8	43.1	181.6	664.2	2 053.8	5 651.4
1977	136.2	1.5	11.3	47.9	179.1	646.7	1 953.2	5 477.6
Average annual percent change								
From 1950–52 to 1975–77	-1.0	-2.4	-1.5	-1.3	-1.3	-1.1	-0.9	-0.6
From 1950–52 to 1966–68	-0.4	-2.4	-1.7	-1.0	-0.8	-0.6	-0.3	0.1
From 1969–71 to 1975–77	-2.4	-3.6	-1.8	-2.2	-3.0	-2.4	-2.4	-2.3

*Combined male and female population in 1971 used as standard.

Five Canadian regions were defined according to geodemographic criteria: Atlantic (Newfoundland, Nova Scotia, Prince Edward Island and New Brunswick), Quebec, Ontario, Prairie (Manitoba, Saskatchewan and Alberta) and Pacific (British Columbia). Data from the Yukon and the Northwest Territories were excluded to avoid problems of interpretation caused by small populations and fluctuating rates.

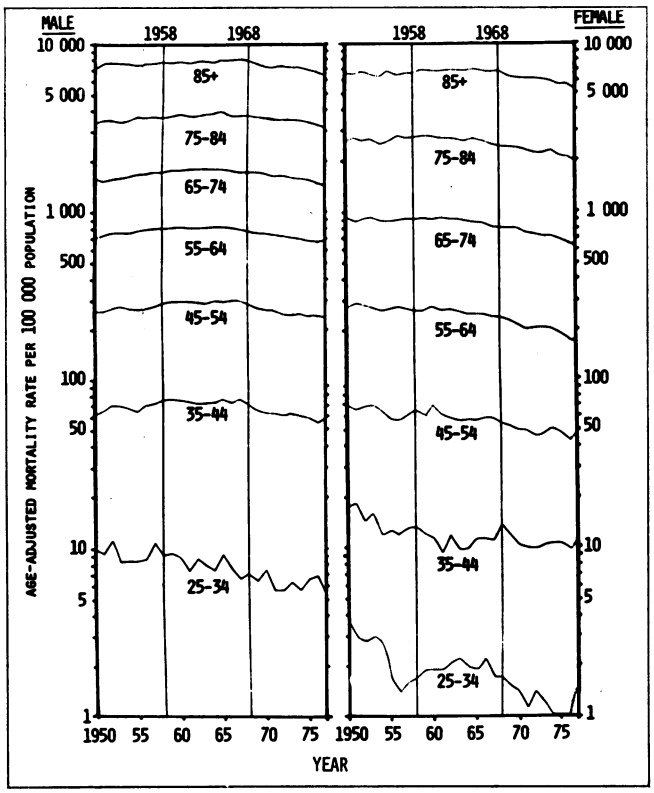

FIG. 2—Mortality trends of ischemic heart disease in Canada in 1950–77.

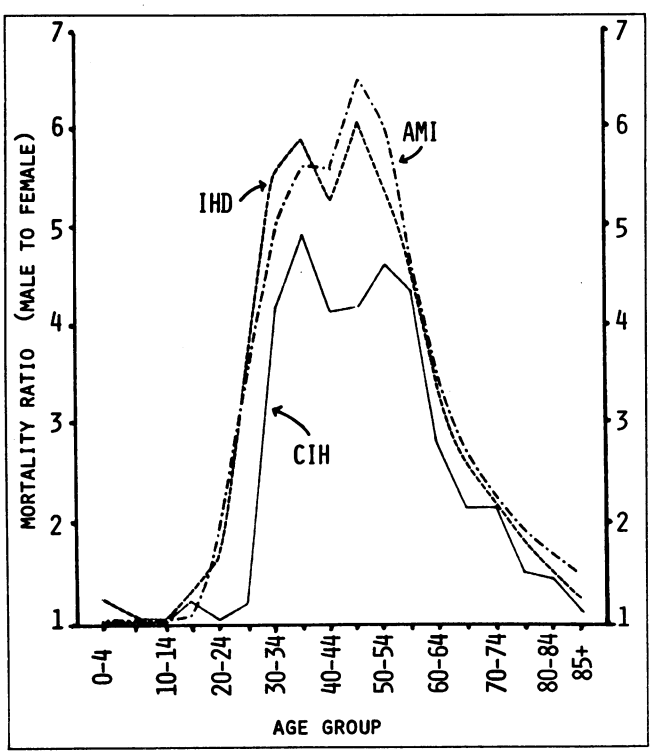

FIG. 3—Average sex ratios (male to female) for mortality in Canada in 1974 through 1976. AMI = acute myocardial infarction; IHD = ischemic heart disease; CIH = chronic ischemic heart disease.

Results

Trends

Mortality rates for cardiovascular disease must be analysed within the context of mortality rates for all causes. Between 1950 and 1977 the age-adjusted mortality rates for all causes declined an average of 0.4% and 1.2% annually for males and females respectively (Fig. 1), while the rates for all the components of cardiovascular disease mortality declined an average of 0.7% and 1.5% annually (Table I). In both diagnostic categories the rates for males remained almost twice as high as those for females.

Deaths due to ischemic heart disease accounted for almost two thirds of all the deaths due to cardiovascular disease in the period reviewed. The mortality rates for males increased (0.5% annually) until 1965, then declined substantially (1.7% annually). The rates for females were relatively constant during the 1950s but declined after 1960 (0.4% annually), with particularly large changes in the 1970s (an average decline of 2.4% annually) (Table II and Fig. 2).

The rate of decline for the various components of ischemic heart disease mortality was not homogeneous however. The rate of death from acute myocardial infarction (ICDA-8 rubric 410) decreased persistently in all age groups in both sexes, at least since 1969, when specific data for this component became available. In the same period the rate of death attributed to other forms of ischemic heart disease (chronic and subacute) increased among women aged 35 to 54 years and among men aged 35 to 64 years. These two forms also exhibited a different sex ratio for mortality in the period 1974 through 1976 (Fig. 3). Whether these phenomena were caused by a true change in survival in the two groups or whether we are dealing with two separate disease entities with different incidence rates still remains to be elucidated.

In contrast, other components of cardiovascular disease mortality have evolved somewhat differently since 1950, with a gradual decline in the rate for cerebrovascular disease but a steep decline in that for hypertensive disease (Fig. 1). The decline began at least in the early 1950s for both diseases and both sexes, but the rates for hypertensive disease declined markedly in 1969 (presumably in relation to the introduction of ICDA-8). Although coexisting hypertensive disease has not been completely excluded from the deaths due to cerebrovascular disease, the decline in mortality was earlier for hypertensive disease. The two trends exhibit some similarities — namely the absence of a marked sex predominance and the peculiar evolution of the rates for females, which were higher than those for males in the early period but later fell below those for males.

It is well known that the mortality rates for chronic rheumatic heart disease have been declining for a long time in Canada. Conversely, the rates for diseases of the arteries, arterioles and capillaries (ICDA-8 rubrics 440 to 448) have shown a slight upsurge since 1965, and those for the residual group called "other forms of heart disease" (ICDA-8 rubrics 420 and 429) have exhibited a similar trend.

Changes in age patterns

The annual rate of decline in cardiovascular disease mortality for all ages was less marked in the first period (1950–52 to 1966–68) for males (0.3%) and females (1.4%) than in the second period (1969–71 to 1975–77), when the reductions were 1.6% and 2.5% respectively (Table I). For males most of the decline in the first period was in those aged 25 to 34 years (2.5%); in the second period, however, a steeper decline occurred in those aged 35 to 64 years, whereas the decrease was only slight for those aged 25 to 34 years. The annual rate of decline among females in the first period was most marked (over 2.5%) for those aged 25 to 54 years, whereas the rate in the second period showed a steeper decline that was distributed over a wider range of ages.

As for ischemic heart disease, all groups of males except those under 35 years of age experienced an increase in mortality in the first period, whereas every age group showed a consistent reduction during the second, and all groups of females showed a decline in both periods, though the decline was more marked in every age group during the second period. It appears that the largest average annual relative changes, –1.5% for males and –2.4% for females, occurred among those under 35 years of age during the first period (Table II).

The age-specific mortality rates for ischemic heart disease still showed a pronounced male predominance between the second and seventh decades, a feature not observed for cerebrovascular and hypertensive disease (Fig. 4).

A different pattern of change was observed for cerebrovascular disease mortality (Table III and Fig. 1): there was a continuous sharp drop in the rates for both sexes during both periods, and the drop was particularly noticeable among females over 45 years of age.

Examination of the graphs of mortality rates for ischemic heart disease and cerebrovascular disease since 1866 leaves the impression that the deaths from both diseases occurred at progressively later ages in successive cohorts, particularly in females (Fig. 5).

Regional variations

In the last few decades significant regional changes in cardiovascular disease mortality have also occurred in Canada, but the various components have been affected in different ways. Only the changes related to ischemic heart disease and cerebrovascular disease (Tables IV and V and Fig. 6) will be given attention here.

Generally, in most regions the mortality rates for both ischemic heart disease and cerebrovascular disease declined in both males and females, and the divergence in rates between the sexes became more marked.

The mortality rates for ischemic heart disease showed the following trends:

- Ontario continued to maintain the highest rates in Canada despite a marked decline that commenced in the early 1960s for males and in the mid-1950s for females.
- The Atlantic region experienced the least decline for both sexes (slopes –1.33 for males and –2.51 for females).
- Quebec, which originally ranked third among the five regions, continued to hold the same rank, though it has experienced a sustained decline for both sexes since the middle to late 1960s.
- The Prairie region maintained the lowest rates for both sexes, and the decline in these rates, which was the first to become apparent in Canada (in the 1950s), continued.

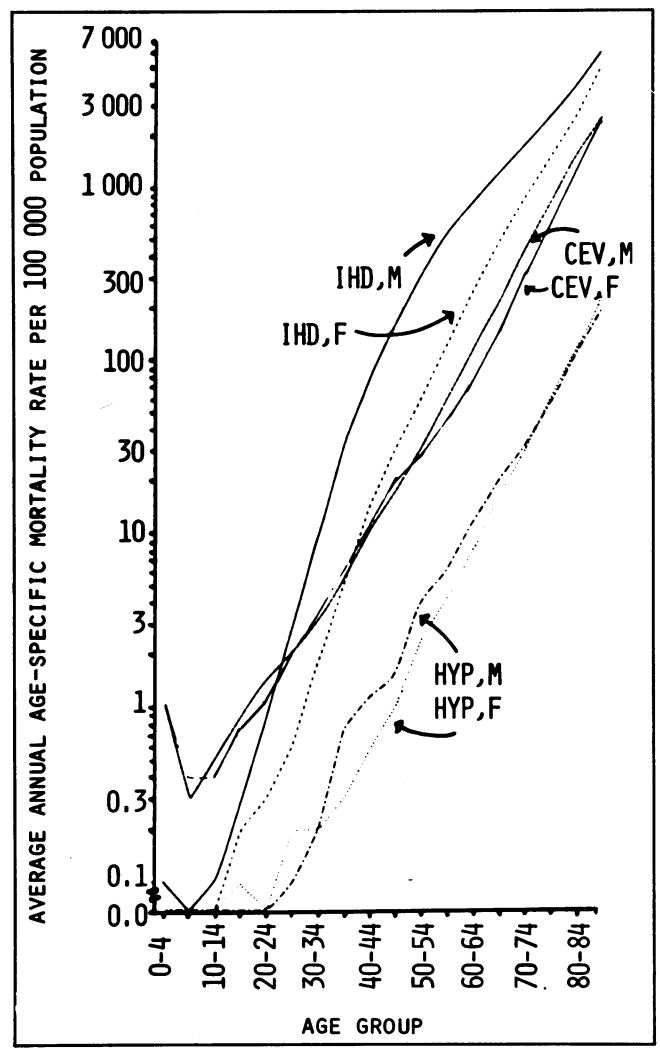

FIG. 4—Age patterns of mortality in Canada in 1975 through 1977 for males (M) and females (F). IHD = ischemic heart disease; CEV = cerebrovascular disease; HYP = hypertensive disease.

Table III—Age-adjusted mortality rates for cerebrovascular disease in Canada, by age

Year	Age (yr); rate per 100 000 population*							
	All	25–34	35–44	45–54	55–64	65–74	75–84	85+
				Males				
1950	101.1	2.6	9.9	44.6	164.0	516.4	1 488.3	2 974.0
1951	102.1	2.9	10.8	42.9	157.5	516.6	1 490.7	3 176.2
1952	102.7	3.6	11.2	43.6	162.1	521.1	1 515.5	3 059.8
1953	107.4	2.8	12.1	43.7	164.9	532.7	1 581.6	3 388.4
1954	102.1	3.8	11.2	38.7	163.2	488.5	1 520.5	3 275.6
1955	103.5	3.2	9.8	39.7	138.0	513.4	1 626.1	3 227.6
1956	102.4	2.9	9.9	39.2	141.8	505.6	1 561.8	3 315.4
1957	105.8	3.6	9.7	40.7	143.9	495.9	1 632.6	3 599.3
1958	103.6	2.9	8.6	39.2	143.4	503.9	1 588.1	3 427.1
1959	104.0	3.0	10.4	38.5	141.6	488.9	1 617.2	3 514.5
1960	100.5	2.7	9.4	34.9	135.5	483.0	1 555.7	3 408.5
1961	94.0	3.1	9.1	31.1	127.6	442.0	1 441.3	3 307.7
1962	93.0	3.1	9.2	34.5	120.9	429.6	1 458.8	3 197.8
1963	90.5	2.3	9.0	31.6	122.9	421.6	1 402.2	3 141.0
1964	87.0	3.4	10.2	35.8	116.7	405.1	1 359.5	2 868.3
1965	89.6	3.6	9.0	30.0	112.8	421.6	1 388.2	3 200.5
1966	88.2	3.7	9.2	30.0	112.3	398.4	1 351.5	3 300.9
1967	86.6	3.5	10.5	32.5	115.1	393.3	1 306.1	3 148.0
1968	85.3	3.7	9.2	33.2	105.3	387.6	1 297.9	3 169.9
1969	82.6	3.4	9.2	31.7	112.2	382.9	1 232.7	2 981.6
1970	81.8	3.0	9.7	29.3	104.6	383.6	1 247.9	2 918.3
1971	80.6	3.1	8.5	31.2	99.4	368.2	1 240.8	2 926.7
1972	81.7	2.6	11.8	29.6	105.4	386.2	1 245.1	2 853.3
1973	78.8	2.8	8.7	31.4	104.7	364.9	1 188.2	2 797.2
1974	78.2	2.5	10.7	28.1	104.5	361.3	1 191.8	2 773.6
1975	75.2	2.6	8.2	23.9	96.2	335.3	1 139.7	2 903.7
1976	71.6	3.0	7.5	24.4	87.0	321.1	1 094.9	2 716.2
1977	68.2	2.4	8.3	26.6	84.7	316.0	1 042.2	2 434.1
Average annual percent change								
From 1950–52 to 1975–77	–1.2	–0.5	–1.0	–1.7	–1.8	–1.5	–1.1	–0.5
From 1950–52 to 1966–68	–0.9	1.2	–0.5	–1.6	–1.8	–1.4	–0.7	0.3
From 1969–71 to 1975–77	–2.2	–3.4	–2.4	–3.3	–2.8	–2.3	–2.1	–1.9
				Females				
1950	108.7	2.2	13.0	53.0	176.4	541.3	1 578.4	3 275.2
1951	111.4	2.4	12.5	55.7	175.2	529.5	1 651.9	3 498.3
1952	110.7	3.8	15.2	61.7	160.1	523.4	1 655.6	3 400.7
1953	112.8	2.8	13.2	59.8	165.0	522.6	1 684.7	3 685.5
1954	106.5	3.6	11.8	49.4	146.9	488.9	1 595.0	3 690.9
1955	105.2	1.4	10.6	46.0	146.6	472.1	1 628.3	3 629.0
1956	105.0	3.3	10.9	49.3	148.9	463.5	1 627.6	3 551.9
1957	106.9	3.4	10.5	44.9	144.0	463.1	1 680.1	3 785.1
1958	102.7	3.8	9.9	37.1	127.8	459.4	1 604.0	3 769.0
1959	102.8	2.6	8.8	41.1	128.8	450.5	1 600.9	3 863.4
1960	97.6	2.8	9.9	34.0	116.1	419.0	1 498.7	3 946.0
1961	95.6	3.6	8.6	36.7	113.6	395.5	1 481.8	3 853.4
1962	91.0	1.7	8.2	33.1	104.6	399.1	1 389.1	3 677.1
1963	88.8	3.0	8.8	34.7	100.3	364.3	1 402.1	3 564.5
1964	82.9	3.6	8.8	35.3	98.8	344.3	1 300.9	3 180.1
1965	84.0	2.4	9.8	30.0	89.6	342.7	1 303.6	3 574.4
1966	81.2	3.0	7.3	28.5	96.3	321.6	1 263.3	3 423.1
1967	76.1	3.0	9.6	29.2	83.6	302.8	1 147.1	3 315.3
1968	73.8	2.8	10.9	27.0	76.6	291.5	1 157.4	3 107.9
1969	72.8	4.2	11.4	29.3	76.4	276.5	1 120.3	3 140.4
1970	70.2	4.1	11.8	26.9	74.7	271.6	1 088.5	2 962.1
1971	69.3	3.3	10.9	26.6	72.5	262.3	1 060.7	3 038.6
1972	69.3	3.1	12.4	25.7	72.3	270.1	1 059.6	2 993.1
1973	65.5	3.6	8.7	26.3	73.8	244.5	1 000.5	2 866.2
1974	64.7	3.7	9.2	24.8	66.2	243.7	975.9	2 941.6
1975	63.8	3.4	10.2	25.1	68.2	234.3	989.6	2 769.5
1976	59.7	2.6	8.2	25.6	59.3	226.2	916.8	2 625.6
1977	55.9	2.4	8.5	23.7	54.9	203.5	835.1	2 613.9
Average annual percent change								
From 1950–52 to 1975–77	–1.8	–0.0	–1.4	–2.2	–2.6	–2.3	–1.8	–0.9
From 1950–52 to 1966–68	–1.8	0.3	–1.8	–3.0	–2.9	–2.5	–1.6	–0.2
From 1969–71 to 1975–77	–2.8	–2.1	–2.3	–1.8	–3.3	–3.4	–2.8	–2.3

*Combined male and female population in 1971 used as standard.

● The Pacific region had the second-lowest rates for both sexes. The reduction in rates became apparent in the mid-1960s for males and in the mid-1950s for females.

With regard to cerebrovascular disease, all the regions experienced a significant decline in mortality, the pattern for each region being somewhat similar to that for ischemic heart disease even though the regional and sex differences were not as marked. Ontario, which originally had the highest rate in Canada, has lately had a middle position for both sexes. The Atlantic region has shown the sharpest decline in recent years. The Prairie and Pacific regions have shown rates lower than the national rate for both males and females, as observed for ischemic heart disease.

Discussion

Despite surprising regional differences in the time of onset, a marked drop in the age-adjusted mortality rates for ischemic heart disease has occurred year after year in Canada since at least 1965, amounting to a 16.4% reduction between 1969 and 1977 for the two sexes combined.

During the same period a decline has occurred as well in mortality rates for all causes and for the broad category of cardiovascular disease. It seems, therefore, that the decline in the mortality of ischemic heart disease is real, and it is unlikely that it can be simply attributed to an artefact resulting from changes in diagnostic fashions, increased awareness about the problem or shifts in the classification of deaths. The few diagnostic categories for which there has been an increase in the mortality in the same period (lung cancer, sui-

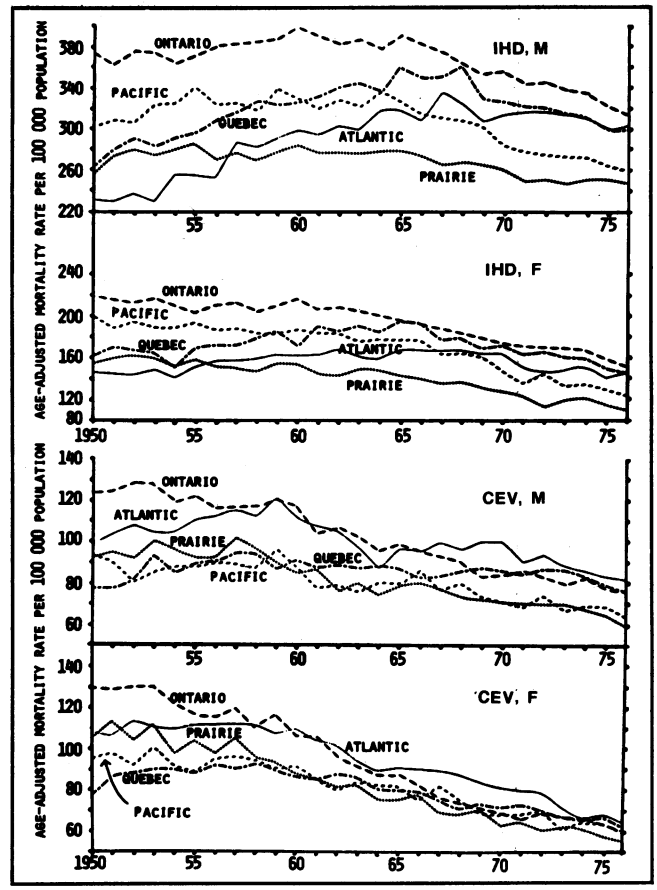

FIG. 6—Regional mortality trends in Canada in 1950–77 for males (M) and females (F). IHD = ischemic heart disease; CEV = cerebrovascular disease.

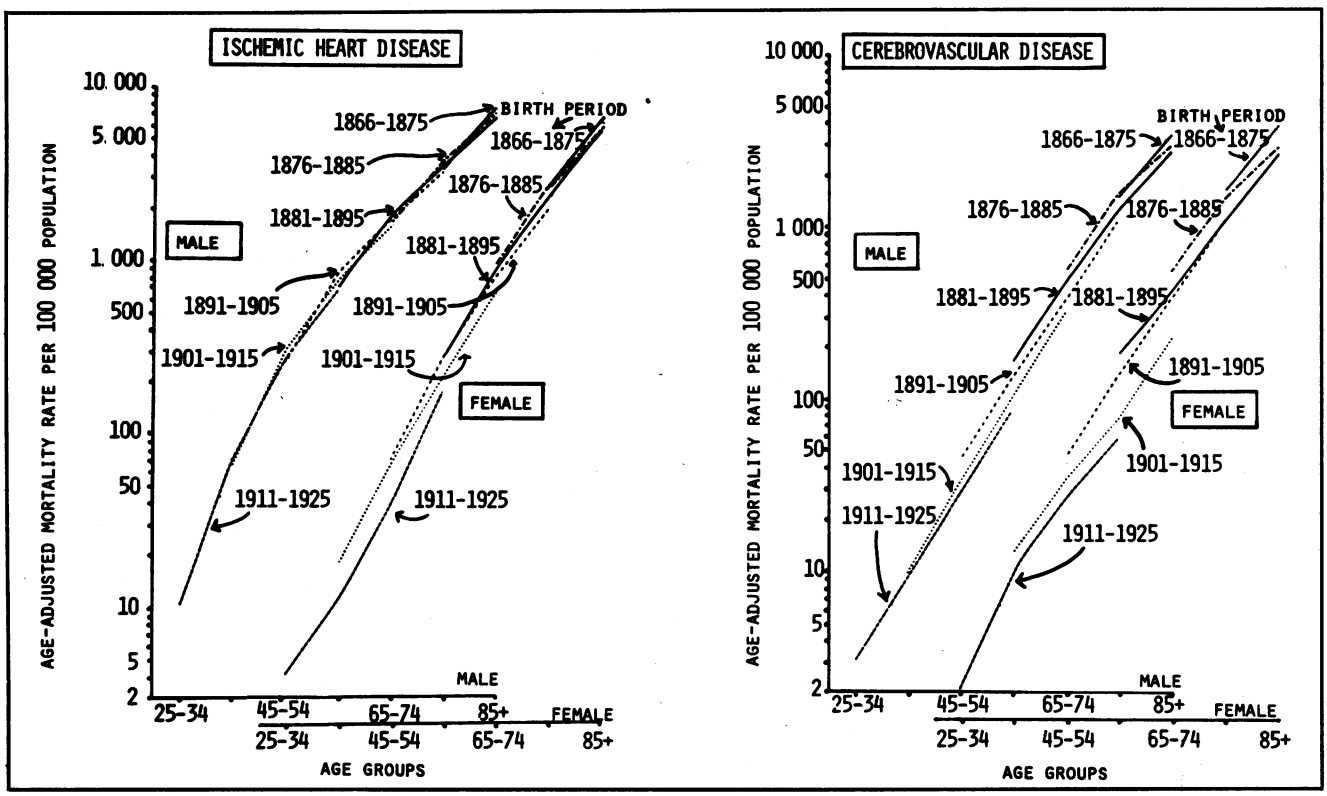

FIG. 5—Age-adjusted mortality rates for successive birth cohorts and ages at time of death in 1950, 1960, 1970 and 1976 in Canada.

Table IV—Age-adjusted mortality rates for ischemic heart disease in Canada, by geographic region

Year	Region; rate per 100 000 population*					
	Canada	Atlantic	Quebec	Ontario	Prairie	Pacific
			Males			
1950	301.7	230.7	262.3	373.5	256.0	303.3
1951	306.0	228.6	280.7	362.9	275.2	307.9
1952	314.5	236.9	289.6	375.4	280.1	304.9
1953	311.6	229.1	281.7	373.5	272.8	323.0
1954	314.8	254.7	289.7	363.6	280.3	325.4
1955	321.3	254.2	294.5	370.9	285.8	341.0
1956	321.7	252.0	308.2	380.2	268.7	322.4
1957	330.5	285.9	315.8	382.6	277.3	325.0
1958	329.8	281.8	327.0	383.5	267.8	316.6
1959	335.8	289.8	323.2	387.5	277.1	338.9
1960	340.9	297.9	324.7	397.6	284.1	327.5
1961	336.4	293.5	332.0	389.5	276.2	318.9
1962	338.2	301.8	341.3	382.8	278.0	327.8
1963	338.5	297.6	345.3	386.9	275.0	320.9
1964	338.5	317.8	337.0	377.1	278.7	337.4
1965	347.1	317.0	359.6	392.7	278.8	325.9
1966	337.7	308.4	348.9	382.0	273.2	312.9
1967	335.8	334.1	350.8	374.4	264.4	310.5
1968	332.8	322.5	359.8	362.9	268.2	306.8
1969	320.1	304.6	328.6	353.3	264.1	307.3
1970	317.8	313.8	325.6	355.3	260.9	281.9
1971	309.3	317.0	320.9	343.6	247.9	277.1
1972	310.2	318.4	320.4	344.7	252.0	273.5
1973	304.7	315.9	313.1	337.5	246.3	273.0
1974	305.5	311.7	313.8	335.3	253.4	272.8
1975	293.6	297.2	297.1	321.7	250.7	262.9
1976	290.9	303.1	298.5	314.6	247.1	258.8
Long-term trend (1950–76)						
Chi-square	19.355	27.356	42.120	19.219	7.788	24.822
Y-intercept, 1950	327.3	242.0	298.2	392.5	283.0	337.7
Y-1976	316.5	333.5	336.6	343.1	254.4	279.6
Slope	-0.40	3.39	1.42	-1.83	-1.06	-2.15
Correlation coefficient	0.203	0.840	0.447	-0.663	-0.687	-0.706
Short-term trend (1969–76)						
Chi-square	0.167	1.102	0.291	0.326	0.585	1.079
Y-intercept, 1969	324.9	316.2	335.2	363.5	261.3	299.9
Y-1976	292.2	305.6	298.8	318.6	246.2	257.3
Slope	4.08	-1.33	-4.54	5.61	-1.89	-5.33
Correlation coefficient	0.966	-0.423	0.952	0.961	-0.711	-0.889
			Females			
1950	185.6	148.4	162.1	220.3	153.8	199.8
1951	185.7	145.1	171.3	216.6	159.1	188.2
1952	184.5	143.8	167.2	213.2	162.8	195.3
1953	185.0	149.4	164.2	217.3	159.6	188.4
1954	176.5	139.5	149.2	209.6	151.3	188.5
1955	181.6	150.9	169.5	203.2	159.1	194.0
1956	183.7	157.3	171.7	210.9	150.5	184.5
1957	184.6	156.7	171.7	212.9	151.3	187.8
1958	181.7	158.6	178.4	203.2	144.7	182.5
1959	187.4	164.3	184.7	210.1	155.0	183.3
1960	187.2	160.9	171.7	216.0	155.1	187.3
1961	184.6	162.4	190.0	205.5	142.9	181.8
1962	185.2	169.0	185.3	208.4	141.8	182.9
1963	184.5	161.4	190.0	204.7	150.0	173.5
1964	180.1	157.2	184.4	198.7	145.8	177.4
1965	182.1	169.7	195.2	195.4	142.3	177.2
1966	178.9	166.8	192.6	191.9	139.8	175.6
1967	171.5	167.4	176.9	188.1	133.7	161.5
1968	170.7	167.5	178.7	183.2	136.5	163.5
1969	164.8	163.1	167.8	178.8	131.0	159.5
1970	161.5	163.8	171.2	173.5	127.7	145.9
1971	154.6	149.6	162.2	170.4	122.7	135.4
1972	154.0	144.9	165.5	169.2	112.1	144.5
1973	152.9	149.4	159.7	170.1	121.0	131.6
1974	152.9	154.3	160.3	165.9	121.7	135.3
1975	143.7	140.5	148.3	157.6	114.9	129.4
1976	140.1	147.0	146.1	151.6	110.2	123.8
Long-term trend (1950–76)						
Chi-square	8.686	14.224	26.124	6.119	5.623	10.443
Y-intercept, 1950	195.9	153.8	176.0	228.3	166.5	207.7
Y-1976	152.8	157.8	167.7	162.8	116.6	134.2
Slope	-1.59	0.15	-0.30	-2.43	-1.85	-2.72
Correlation coefficient	0.858	0.127	-0.182	-0.943	-0.937	-0.936
Short-term trend (1969–76)						
Chi-square	0.260	1.476	0.566	0.359	1.128	1.314
Y-intercept, 1969	167.4	162.9	175.0	182.3	131.1	156.7
Y-1976	141.9	142.8	148.6	155.4	111.7	123.8
Slope	-3.19	-2.51	-3.30	-3.36	-2.42	-4.11
Correlation coefficient	-0.957	-0.737	-0.914	-0.943	-0.809	-0.890

*Combined male and female population in 1971 used as standard.

Table V—Age-adjusted mortality rates for cerebrovascular disease in Canada, by geographic region

Year	Region; rate per 100 000 population*					
	Canada	Atlantic	Quebec	Ontario	Prairie	Pacific
			Males			
1950	101.0	97.1	77.4	123.4	92.3	93.8
1951	102.1	103.9	76.6	124.2	95.3	90.4
1952	102.7	107.9	80.8	127.7	91.4	80.4
1953	107.4	103.6	93.1	128.0	101.0	84.9
1954	102.1	103.8	84.5	119.4	95.9	88.4
1955	103.5	111.1	89.2	121.5	91.5	88.4
1956	102.4	112.3	90.2	116.1	91.8	89.7
1957	105.8	115.5	94.6	117.0	101.6	89.3
1958	103.6	111.6	93.6	116.5	96.6	86.9
1959	104.0	121.3	87.0	120.4	88.5	96.0
1960	100.5	109.6	90.6	116.8	84.9	87.1
1961	94.0	107.4	86.6	104.4	86.0	77.0
1962	93.0	104.7	88.5	106.8	76.6	79.1
1963	90.5	97.0	87.1	102.3	80.1	75.4
1964	87.0	87.3	88.4	95.9	74.1	80.3
1965	89.5	96.7	86.7	99.1	78.8	79.3
1966	88.2	94.8	81.6	95.3	79.7	86.4
1967	86.6	99.6	83.3	92.7	78.0	75.8
1968	85.3	95.8	85.6	90.3	73.3	80.3
1969	82.6	100.1	86.6	83.4	72.0	73.4
1970	81.8	100.0	86.0	84.2	69.7	70.9
1971	80.6	89.6	84.3	85.6	70.6	67.8
1972	81.7	94.4	87.3	83.3	70.2	74.1
1973	78.8	87.8	86.7	80.0	69.9	67.1
1974	78.2	86.1	82.7	83.0	66.8	69.3
1975	75.2	82.6	79.2	77.7	65.4	68.7
1976	71.6	81.5	75.7	75.8	58.5	62.9
Long-term trend (1950–76)						
Chi-square	2.857	12.531	7.343	3.343	5.215	6.620
Y-intercept, 1950	110.0	113.3	87.5	132.6	101.2	93.7
Y-1976	75.0	87.9	84.1	74.7	63.3	67.5
Slope	−1.30	−0.94	0.13	2.14	−1.40	0.97
Correlation coefficient	0.952	0.728	0.202	0.977	0.935	0.859
Short-term trend (1969–76)						
Chi-square	0.194	0.450	0.501	0.325	0.552	0.664
Y-intercept, 1969	85.2	102.8	89.8	86.8	74.7	73.9
Y-1976	73.8	80.5	78.8	77.6	62.6	65.7
Slope	−1.43	−2.80	−1.38	1.15	1.51	1.03
Correlation coefficient	0.922	−0.942	0.809	0.822	0.856	0.701
			Females			
1950	108.7	108.0	78.0	130.2	106.4	96.7
1951	111.4	105.9	86.6	129.4	113.8	97.9
1952	110.7	114.0	87.5	130.2	104.0	90.9
1953	112.8	109.6	89.6	129.9	112.1	100.6
1954	106.5	108.5	89.9	122.4	97.5	91.3
1955	105.2	111.6	87.8	117.2	104.2	88.4
1956	105.0	111.5	91.7	115.9	97.8	95.3
1957	106.9	111.7	89.8	118.7	104.5	95.6
1958	102.7	111.5	92.8	109.7	94.8	93.5
1959	102.8	106.9	88.8	116.2	94.1	89.9
1960	97.6	109.7	86.0	106.3	86.5	92.3
1961	95.6	104.2	85.4	106.3	84.8	85.0
1962	91.0	103.2	88.0	96.4	80.5	80.3
1963	88.8	93.9	86.0	92.4	83.4	83.5
1964	82.9	88.8	78.6	87.3	74.6	82.1
1965	84.0	90.6	80.3	87.9	75.2	82.4
1966	81.2	90.0	79.1	82.8	78.6	74.7
1967	76.1	89.6	75.3	74.7	68.6	81.5
1968	73.8	87.5	71.3	73.6	67.9	75.1
1969	72.8	84.4	73.9	70.5	70.8	69.2
1970	70.2	81.0	71.1	70.2	63.1	68.1
1971	69.3	80.4	72.6	66.4	64.7	67.5
1972	69.3	79.5	69.8	69.1	60.2	70.0
1973	65.5	71.3	67.2	66.5	61.6	60.9
1974	64.7	67.1	64.9	65.2	60.8	64.3
1975	63.8	68.9	66.9	63.1	57.7	63.8
1976	59.7	65.2	61.4	59.2	54.9	59.2
Long-term trend (1950–76)						
Chi-square	2.419	7.184	7.224	5.374	4.348	4.436
Y-intercept, 1950	118.8	120.9	94.3	137.7	114.0	102.6
Y-1976	59.6	70.2	66.8	54.8	52.9	61.8
Slope	2.19	−1.88	1.02	3.07	2.26	1.51
Correlation coefficient	0.985	−0.944	0.863	0.985	0.978	0.954
Short-term trend (1969–76)						
Chi-square	0.101	0.429	0.218	0.238	0.429	0.581
Y-intercept, 1969	74.5	87.8	75.7	72.8	69.7	71.3
Y-1976	61.0	64.6	62.9	61.2	55.5	60.8
Slope	−1.68	−2.90	−1.60	1.44	1.77	1.31
Correlation coefficient	−0.973	−0.958	0.938	0.922	0.909	0.811

*Combined male and female population in 1971 used as standard.

cide, homicide and cirrhosis) are not likely to be confounded with ischemic heart disease. It is also well known that mortality rates for cerebrovascular and hypertensive disease began to decline more than two decades ago.

In the United States a 20.7% decline has been reported in the mortality of ischemic heart disease for both sexes between 1968 and 1976.[4-7] Nevertheless, when compared with the Canadian mortality rates (after proper adjustments) those of the United States are still higher for both males and females.

In addition, the mortality rates for ischemic heart disease have also declined substantially in Australia, Belgium, Finland and Japan[8] and seem to have levelled off or slightly declined in England and Wales.[9]

During the period under review advances have been made in medical and surgical technology, and socioeconomic improvements and changes in lifestyle have also occurred; all of these may have contributed to the decline in mortality. As ischemic heart disease is North America's greatest epidemic and the one with the heaviest economic impact, it is obviously of practical importance to identify the cause(s) of the current decline in its mortality in order to allocate resources to areas where their utilization might be most beneficial.[10,11]

Decreased mortality rates may reflect decreased incidence rates (fewer new cases occurring), improved survival rates or a combination of the two factors.[12] Unfortunately, data on the incidence of ischemic heart disease are lacking in this country, and what evidence is available to elucidate the matter is indirect.

Those in favour of the first explanation have suggested that the current situation may be attributable to changes in lifestyle of the population, with concomitant lessening of the extent of the known major "risk factors". Their arguments are as follows:

- The prevalence of cigarette smoking among adults decreased in Canada by 16% between 1965 and 1977,[13] and a reduction in the levels of nicotine and tar in cigarettes may have played a role. Yet the mortality of ischemic heart disease has declined proportionately more in women and in younger groups, among whom the changes in the prevalence of cigarette smoking have been minimal.
- A reduction in the consumption of saturated fats and cholesterol (with a shift to substitutes) may have led to a drop in the serum cholesterol levels of the population of the United States.[14] Such a change, if it occurred in Canada, may have resulted in some of the reduction in the mortality of ischemic heart disease among middle-aged men, but it probably could not be held accountable for the whole decline.
- Perhaps 46% of Canadians are regularly participating in sports and other forms of exercise, according to a recent survey.[15] However, this is a relatively recent phenomenon whose long-term effects have not as yet been properly assessed.
- Increased emphasis on detection and effective treatment of hypertensive disease has apparently led towards improved control of this condition in the United States, but this has not been documented in Canada.[16,17]

The mortality of hypertension and stroke began to decline in the 1950s, and females experienced a steeper decline than males, as with ischemic heart disease. It has been argued that the decline in the mortality of cardiovascular and ischemic heart disease may have been related to the absence of major epidemics of acute respiratory tract disease (influenza-like illness and pneumonia), but in Canada there has been no parallelism between the two types of disease.[18] In addition, it remains to be seen whether the changes in risk factors we have discussed are compatible with the regional variations observed.

Supporters of the "secondary prevention" hypothesis claim that the decline in the mortality of ischemic heart disease is due, at least to some extent, to improved therapy resulting from the increased use of coronary care units and anticoagulants, the prevention of cardiac arrhythmias and other complications, programs aimed at coping with coronary emergencies outside hospital (so-called cardiopulmonary resuscitation programs)[19,20] and the advent of coronary artery bypass surgery.

Nevertheless, it should be borne in mind that a great proportion of patients with a coronary occlusion die before admission to hospital and that the availability of personnel trained in resuscitation techniques is not yet widespread in Canada. Furthermore, while the contribution of coronary care units and coronary bypass surgery to long-term survival is still being debated,[21-23] the implementation of these techniques across Canada is relatively recent. It would be difficult, then, to reconcile the potential effects of techniques recently implemented with a reduction in mortality that started in the early to middle 1960s.

Considerable differences in mortality have been observed between geographic regions and between socioeconomic strata within a city.[24-29] While access to medical care is available equally to all Canadians, it seems likely that socioeconomic and cultural factors play a major role in exposure to diverse risk factors and use of medical services.

Because ischemic heart disease is multifactorial there is no easy way of determining which of the factors or combination of factors involved exerts the greatest weight in its genesis — or, conversely, which could potentially be more useful in its prevention and control. Quite possibly a combination of factors may be responsible for the decline in the mortality of this disease. Attempts to determine the reasons for the decline face many problems, which unfortunately are compounded by a paucity of data, especially on cardiovascular disease morbidity and changes in the prevalence and trends of modifiable risk factors for this disease. Establishment of community-based morbidity registries as part of a control program would greatly improve the quality of data and permit future evaluation of control programs and other factors considered to play a possibly important role in the genesis of these diseases.

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